

VF-MHVRB  
Type  
Expansion

IMPACT MIRACLE vibration control end mill series

**VF-MHV**

**VF-6MHV**

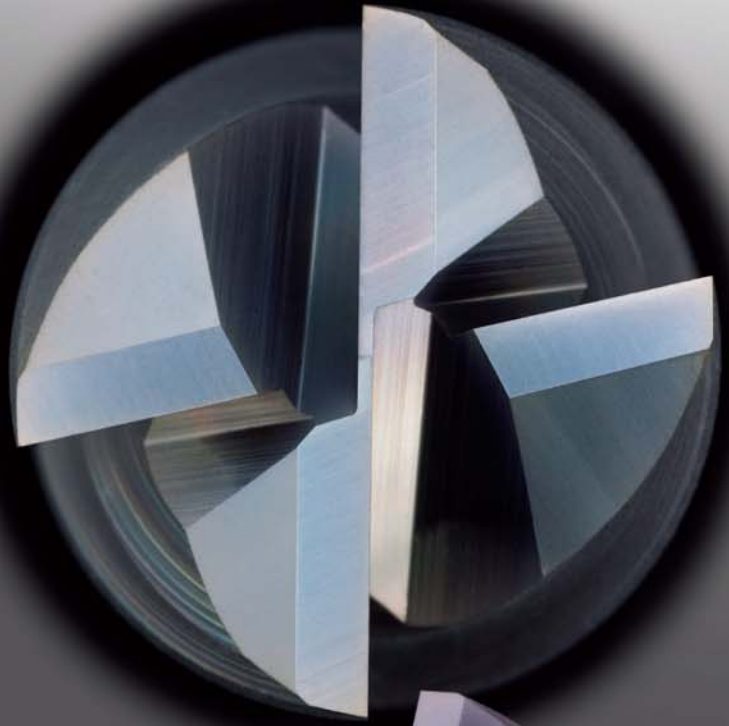
**VF-JHV**

**VF-6MHVRB**

**VF-MHVRB**

## Prevention of vibration with irregular helix flutes.

- Delivers superior vibration resistance for difficult-to-cut materials and long overhang applications.
- Under cut long shank type uses a curved cutting edge to reduce step differences in vertical wall surfaces.



# IMPACT MIRACLE END MILLS

IMPACT MIRACLE vibration control end mill series

**VF-MHV**      **VF-6MHV**  
**VF-JHV**      **VF-6MHVRB**  
**VF-MHVRB** Expansion

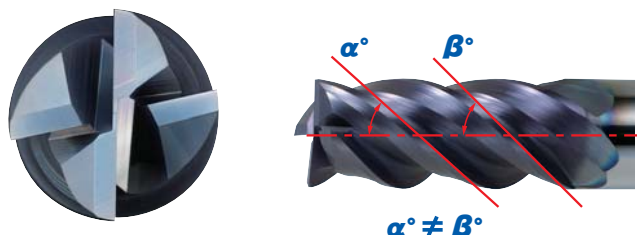
## Features

- In comparison with conventional end mills, the use of irregular helix flutes assists in preventing vibrations.
- Delivers superior vibration resistance for difficult-to-cut materials and applications with a long overhang.
- Impact Miracle coating with high heat resistance is applied. Also suitable for machining hardened steels.
- VF-MHV type with undercut long shank type uses a curved cutting edge at the top of the flute to reduce step differences in vertical wall surfaces.

## Geometry

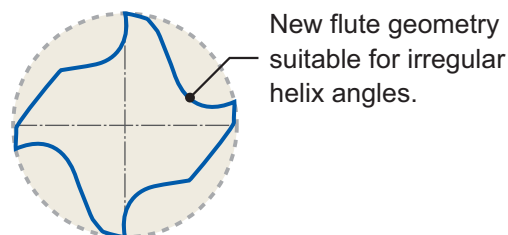
### Irregular helix flutes

**No vibration!**



### Special flute geometry

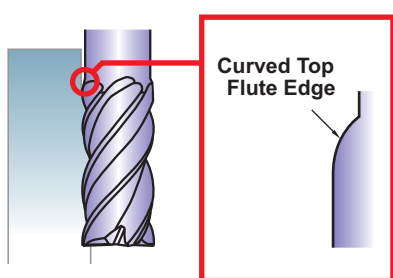
**Improved chip disposal**



### Curved top flute edge

A curved edge at the shank side of the flute is used on the undercut shank type VF-MHV end mills.

This allows deep faces to be finished in steps and minimises the blend mark between steps when compared to conventional sharp cornered end mills.

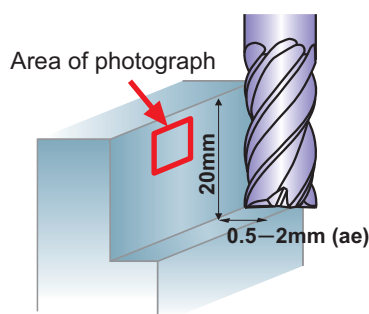


### Surface finish

The VF-MHV reduces vibrations even with an overhang of 5D and achieves superior surface finishes.

#### ● Surface finish comparison

VF-MHV	Conventional



End mill	VMHVD1000 (ø10)
Work material	JIS Ti-6Al-4V
Revolution	4000min <sup>-1</sup> (125m/min)
Feed rate	800mm/min (0.05mm/tooth)
Cutting fluid	Emulsion

## VF-MHV

End mill, Medium cut length, 4 flute, Irregular helix flutes

24 different sizes available

ø2-ø20mm



## VF-JHV

End mill, Semi long cut length, 4 flute, Irregular helix flutes

10 different sizes available

ø2-ø20mm



## VF-MHVRB Expansion

Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes

17 different sizes available

ø6×R0.5-ø20×R4



## VF-6MHV

End mill, Medium cut length, 6 flute, Irregular helix flutes

6 different sizes available

ø6-ø20mm



## VF-6MHVRB

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes

12 different sizes available

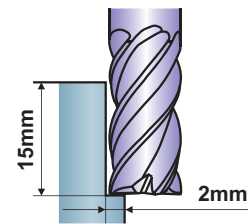
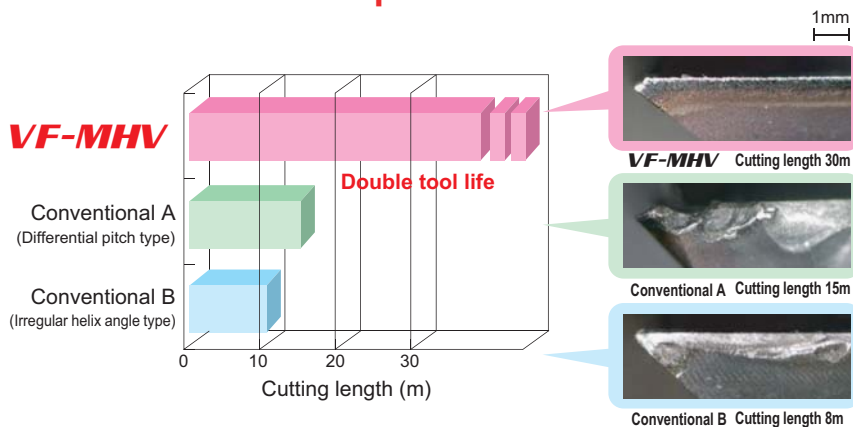
ø6×R0.5-ø20×R2



## Cutting performance

### Tool life comparison when machining stainless steel

#### Double tool life compared to conventional end mills



End mill	VFMHVD1000 (ø10)
Work material	JIS SUS304
Revolution	2900min <sup>-1</sup> (91m/min)
Feed rate	1000mm/min (0.09mm/tooth)
Cutting fluid	Emulsion

### High efficiency finishing with the 6 flute radius end mill

#### VF-6MHVRB

No vibration

1mm scale bar

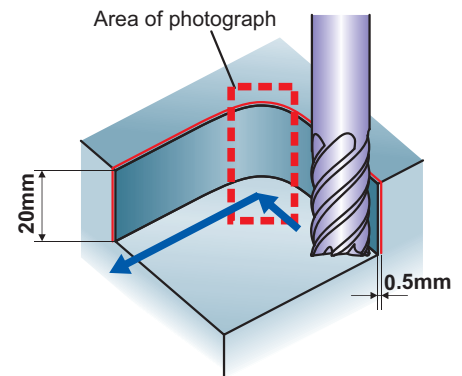
Normal wear

#### Conventional 6 flute radius end mill

Large vibration marks

1mm scale bar

Chipping



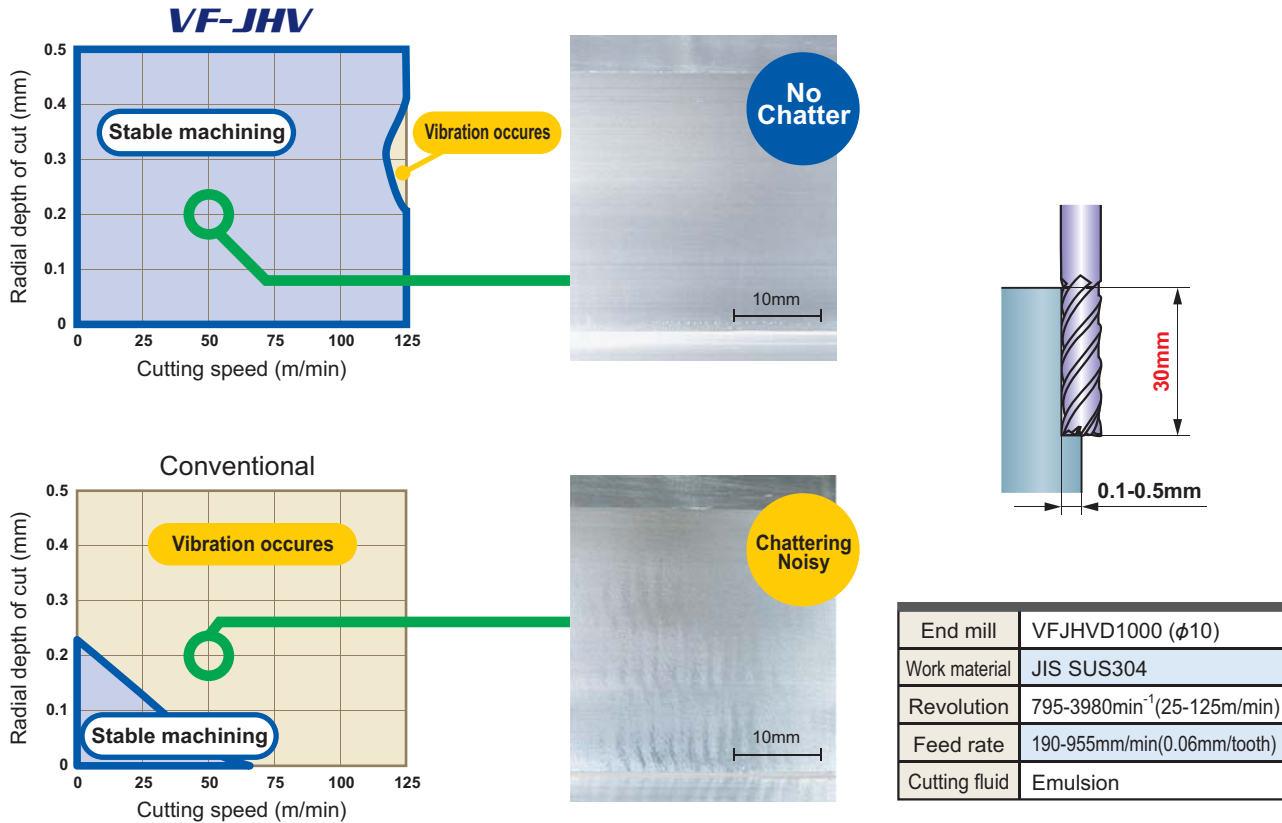
Machining of pocket corners with straight right angle cutting edge paths.

End mill	VF6MHVRBD1000R100 (ø10×R1)
Work material	JIS SUS304
Revolution	6000min <sup>-1</sup> (188m/min)
Feed rate	2160mm/min (0.06mm/tooth)
Cutting fluid	Emulsion

## Cutting performance of VF-JHV

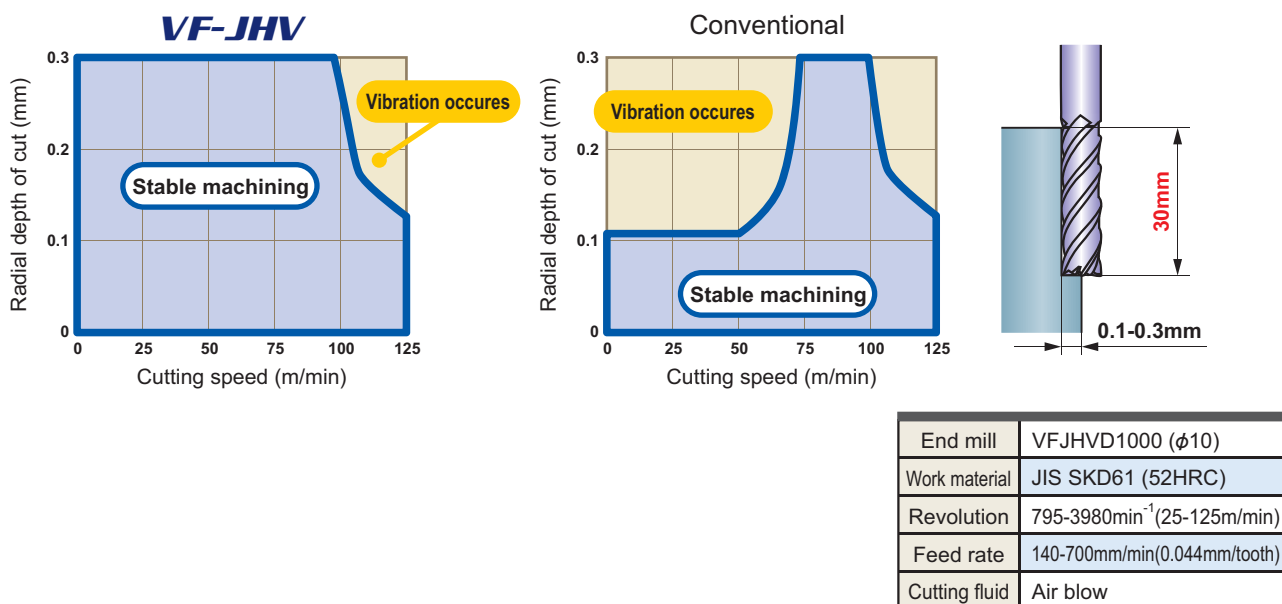
### Stable cutting area comparison when machining stainless steel

Excellent vibration absorption provides stability over a wide range cutting conditions compared with a conventional end mill and a conventional variable pitch end mill.



### Stable cutting area comparison when machining hardened steel

Excellent vibration absorption provides stability over a wide range cutting conditions even on hardened steel.



# VF-MHV

End mill, Medium cut length, 4 flute, Irregular helix flutes



D1 ≤ 12 0 - -0.02  
D1 > 12 0 - -0.03



4 ≤ D4 ≤ 6 0 - -0.008  
8 ≤ D4 ≤ 10 0 - -0.009  
12 ≤ D4 ≤ 16 0 - -0.011  
D4 = 20 0 - -0.013

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
○	○	○		◎	◎		



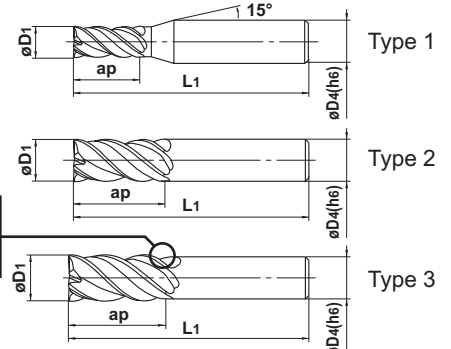
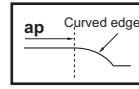
Helix angle D1 < 6



Helix angle D1 ≥ 6



Gash land



Unit : mm

● Impact Miracle end mill with irregular helix flutes ensures stable machining of difficult-to-cut materials and with long overhangs.

Order Number	Dia.	Length of Cut	Overall Length	Shank Dia.	No. of Flute	Stock	Type
	D1	ap	L1	D4	N		
VFMHVD0200	2	4	45	4	4	●	1
D0250	2.5	5	45	4	4	●	1
D0300	3	8	45	6	4	●	1
D0350	3.5	8	45	6	4	●	1
D0400	4	11	45	6	4	●	1
D0500	5	13	50	6	4	●	1
D0600	6	13	50	6	4	●	2
D0600A070	6	13	70	6	4	●	2
D0700	7	19	60	8	4	●	1
D0800	8	19	60	8	4	●	2
D0800A080	8	19	80	8	4	●	2
D0900	9	22	70	10	4	●	1
D1000A100S08	10	22	100	8	4	●	3
D1000	10	22	70	10	4	●	2
D1000A100	10	22	100	10	4	●	2
D1100	11	26	100	10	4	●	3
D1200A110S10	12	26	110	10	4	●	3
D1200	12	26	75	12	4	●	2
D1200A110	12	26	110	12	4	●	2
D1300	13	26	110	12	4	●	3
D1400A130S12	14	32	130	12	4	●	3
D1600	16	35	90	16	4	●	2
D1800A150S16	18	42	150	16	4	●	3
D2000	20	45	110	20	4	●	2

● : Inventory maintained.

# IMPACT MIRACLE END MILLS

## VF-JHV

End mill, Semi long cut length, 4 flute, Irregular helix flutes



$D1 \leq 12$  0 - -0.02  
 $D1 > 12$  0 - -0.03



$D4 = 6$  0 - -0.008  
 $8 \leq D4 \leq 10$  0 - -0.009  
 $12 \leq D4 \leq 16$  0 - -0.011  
 $D4 = 20$  0 - -0.013

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel ( $\leq 45\text{HRC}$ )	Hardened Steel ( $\leq 55\text{HRC}$ )	Hardened Steel ( $> 55\text{HRC}$ )	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
○	○	○		◎	◎		



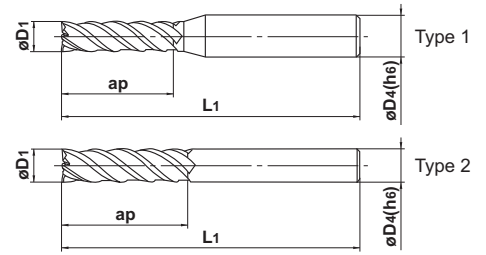
Helix angle  
 $D1 \leq 6$



Helix angle  
 $D1 > 6$



Gash land



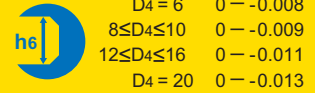
- Impact Miracle end mill with irregular helix flutes ensures stable machining of difficult-to-cut materials.
- Suitable for machining with long axial depth of cut.

Unit : mm

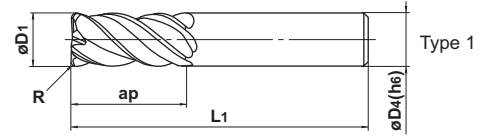
Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VFJHVD0200	2	8	60	6	4	●	1
D0300	3	12	60	6	4	●	1
D0400	4	16	60	6	4	●	1
D0500	5	20	60	6	4	●	1
D0600	6	24	60	6	4	●	2
D0800	8	28	80	8	4	●	2
D1000	10	35	90	10	4	●	2
D1200	12	40	100	12	4	●	2
D1600	16	55	125	16	4	●	2
D2000	20	60	140	20	4	●	2

# VF-MHVRB

Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes



Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
○	○	○		◎	◎		



- Impact Miracle end mill with irregular helix flutes ensures stable machining of difficult-to-cut materials and with long overhangs.

Unit : mm

Order Number	Dia.	Corner R	Length of Cut	Overall Length	Shank Dia.	No. of Flute	Stock	Type
	D1	R	ap	L1	D4	N		
<b>VFMHVRBD0600R050</b>	6	0.5	13	50	6	4	●	1
<b>D0600R100</b>	6	1	13	50	6	4	●	1
<b>D0800R050</b>	8	0.5	19	60	8	4	●	1
<b>D0800R100</b>	8	1	19	60	8	4	●	1
<b>D1000R050</b>	10	0.5	22	70	10	4	●	1
<b>D1000R100</b>	10	1	22	70	10	4	●	1
<b>D1000R200</b>	10	2	22	70	10	4	●	1
<b>D1200R050</b>	12	0.5	26	75	12	4	●	1
<b>D1200R100</b>	12	1	26	75	12	4	●	1
<b>D1200R200</b>	12	2	26	75	12	4	●	1
<b>D1600R100</b>	16	1	35	90	16	4	●	1
<b>D1600R200</b>	16	2	35	90	16	4	●	1
<b>D1600R300</b>	16	3	35	90	16	4	●	1
<b>D2000R100</b>	20	1	45	110	20	4	●	1
<b>D2000R200</b>	20	2	45	110	20	4	●	1
<b>D2000R300</b>	20	3	45	110	20	4	●	1
<b>NEW D2000R400</b>	20	4	45	110	20	4	●	1

# IMPACT MIRACLE END MILLS

## VF-6MHV

End mill, Medium cut length, 6 flute, Irregular helix flutes

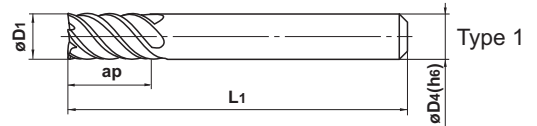


D1 ≤ 12 0 - -0.02  
D1 > 12 0 - -0.03



D4 = 6 0 - -0.008  
8 ≤ D4 ≤ 10 0 - -0.009  
12 ≤ D4 ≤ 16 0 - -0.011  
D4 = 20 0 - -0.013

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
○	○	○		◎	◎		



Helix angle Gash land

- Newly developed irregular helix 6 flute geometry reduces vibrations and achieves high efficiency machining.
- Suitable for machining of difficult-to-cut materials such as stainless steel, titanium alloy and inconel.

Unit : mm

Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VF6MHVD0600	6	13	50	6	6	●	1
D0800	8	19	60	8	6	●	1
D1000	10	22	70	10	6	●	1
D1200	12	26	75	12	6	●	1
D1600	16	32	90	16	6	●	1
D2000	20	38	100	20	6	●	1



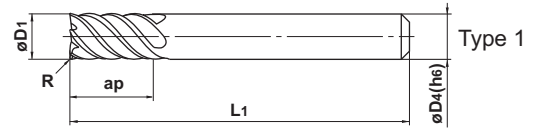
# VF-6MHVRB

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes



D4 = 6	0 - -0.008
8 ≤ D4 ≤ 10	0 - -0.009
12 ≤ D4 ≤ 16	0 - -0.011
D4 = 20	0 - -0.013

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
○	○	○		◎	◎		



Helix angle

- Newly developed irregular helix 6 flute geometry reduces vibrations and achieves high efficiency machining.
- Suitable for machining of difficult-to-cut materials such as stainless steel, titanium alloy and inconel.

Unit : mm

Order Number	Dia.	Corner R	Length of Cut	Overall Length	Shank Dia.	No. of Flute	Stock	Type
	D1	R	ap	L1	D4	N		
VF6MHVRBD0600R050	6	0.5	13	50	6	6	●	1
D0600R100	6	1	13	50	6	6	●	1
D0800R050	8	0.5	19	60	8	6	●	1
D0800R100	8	1	19	60	8	6	●	1
D1000R050	10	0.5	22	70	10	6	●	1
D1000R100	10	1	22	70	10	6	●	1
D1200R050	12	0.5	26	75	12	6	●	1
D1200R100	12	1	26	75	12	6	●	1
D1600R100	16	1	32	90	16	6	●	1
D1600R200	16	2	32	90	16	6	●	1
D2000R100	20	1	38	100	20	6	●	1
D2000R200	20	2	38	100	20	6	●	1

# IMPACT MIRACLE END MILLS

## VF-MHV

End mill, Medium cut length, 4 flute, Irregular helix flutes

## VF-MHV RB

Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes

### Shoulder Milling

Work material	Carbon Steel, Alloy Steel (-30HRC) JIS SS400, JIS S50C, JIS SCM Cast Iron, JIS FC250		Alloy Steel, Tool Steel Pre-hardened Steel (30-45HRC) JIS SKD61, NAK		Austenitic Stainless Steel JIS SUS304, JIS SUS316 Titanium Alloy JIS Ti-6Al-4V		Hardened Steel (45-55HRC) JIS SKD61		Heat Resistant Alloys Inconel	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
2	21000	1100	21000	1100	14000	560	9600	310	4800	130
3	15000	1250	15000	1250	10600	850	7400	380	4200	200
4	11000	1400	11000	1400	8000	960	5600	400	3200	220
5	9600	1920	9600	1920	6400	1020	4500	430	2500	250
6	8000	2240	8000	2240	5300	1060	3700	440	2100	250
7	6800	1900	6800	1900	4500	1010	3200	450	1800	260
8	6000	1680	6000	1680	4000	960	2800	450	1600	260
9	5300	1480	5300	1480	3500	840	2500	450	1400	220
10	4800	1440	4800	1440	3200	770	2200	440	1300	210
11	4400	1350	4400	1350	2900	760	2000	400	1200	190
12	4000	1250	4000	1250	2700	760	1900	380	1100	180
13	3700	1180	3700	1180	2500	700	1700	360	1000	160
14	3400	1160	3400	1160	2300	640	1600	350	900	140
16	3000	1140	3000	1140	2000	560	1400	340	800	130
18	2700	970	2700	970	1800	550	1200	340	700	110
20	2400	860	2400	860	1600	510	1100	330	600	100

≤0.2D  
≤1.5D

≤0.1D  
≤1.5D

≤0.05D  
≤1.5D

D:Dia.

### Slotting

Work material	Carbon Steel, Alloy Steel (-30HRC) JIS SS400, JIS S50C, JIS SCM Cast Iron, JIS FC250		Alloy Steel, Tool Steel Pre-hardened Steel (30-45HRC) JIS SKD61, NAK		Austenitic Stainless Steel JIS SUS304, JIS SUS316 Titanium Alloy JIS Ti-6Al-4V		Hardened Steel (45-55HRC) JIS SKD61		Heat Resistant Alloys Inconel	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
2	17000	680	10000	400	9600	310	4800	130	3200	80
3	12000	720	6900	410	7400	380	3200	140	2700	110
4	9200	810	5600	490	5600	400	2400	150	2000	120
5	7600	1060	4500	630	4500	410	1900	170	1600	130
6	6400	1280	3700	740	3700	440	1600	190	1300	160
7	5500	1210	3200	700	3200	410	1400	190	1100	140
8	4800	1150	2800	670	2800	390	1200	190	1000	130
9	4200	1010	2500	600	2500	350	1100	180	900	130
10	3800	910	2200	530	2200	350	1000	160	800	130
11	3500	900	2000	530	2000	320	900	160	720	120
12	3200	900	1900	530	1900	300	800	160	660	110
13	2900	810	1700	480	1700	290	730	150	610	100
14	2700	760	1600	450	1600	290	680	140	570	90
16	2400	670	1400	390	1400	280	600	120	500	80
18	2100	670	1200	380	1200	270	530	120	440	70
20	1900	610	1100	350	1100	260	480	120	400	60

≤1D  
(MAX. 12mm)

≤0.5D

≤0.2D

D:Dia.

- 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective. When cutting heat-resistant alloys, the use of non water-soluble cutting fluid is recommended.
- 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
- 3) The irregular helix flute end mill has a larger effect on controlling the vibrations when compared to standard end mills. However, if the rigidity of the machine or the workpiece installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set the depth of cut smaller.
- 4) For shoulder milling, climb cutting is recommended.

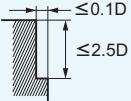
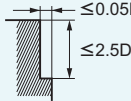
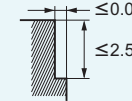


# VF-JHV

End mill, Semi long cut length, 4 flute, Irregular helix flutes

## Shoulder Milling

Work material	Carbon Steel, Alloy Steel (-30HRC) JIS SS400, JIS S50C, JIS SCM Cast Iron, JIS FC250		Alloy Steel, Tool Steel Pre-hardened Steel (30-45HRC) JIS SKD61, NAK		Austenitic Stainless Steel JIS SUS304, JIS SUS316 Titanium Alloy JIS Ti-6Al-4V		Hardened Steel (45-55HRC) JIS SKD61		Heat Resistant Alloys Inconel	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>2</b>	16000	530	10000	320	10000	300	7400	140	3800	55
<b>3</b>	12000	820	7600	470	7600	440	5600	280	2500	80
<b>4</b>	9500	950	6000	520	6000	510	4500	310	1900	110
<b>5</b>	7600	1000	4800	550	4800	540	3600	330	1500	110
<b>6</b>	6300	1100	4000	610	4000	600	3000	330	1300	110
<b>8</b>	4700	1100	3000	630	3000	600	2200	330	960	100
<b>10</b>	3800	1000	2400	610	2400	570	1800	310	760	100
<b>12</b>	3100	980	2000	580	2000	520	1500	280	640	80
<b>16</b>	2300	810	1500	480	1500	420	1100	240	480	65
<b>20</b>	1900	740	1200	430	1200	390	900	220	380	50

Depth of cut	Carbon Steel, Alloy Steel (-30HRC) JIS SS400, JIS S50C, JIS SCM Cast Iron, JIS FC250		Alloy Steel, Tool Steel Pre-hardened Steel (30-45HRC) JIS SKD61, NAK		Austenitic Stainless Steel JIS SUS304, JIS SUS316 Titanium Alloy JIS Ti-6Al-4V		Hardened Steel (45-55HRC) JIS SKD61		Heat Resistant Alloys Inconel	
										

D:Dia.

- 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective. When cutting heat-resistant alloys, the use of non water-soluble cutting fluid is recommended.
- 2) The irregular helix flute end mill has a larger effect on controlling vibrations when compared to standard end mills. However, if the rigidity of the machine or the workpiece installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately.
- 3) Climb cutting is recommended.

# IMPACT MIRACLE END MILLS

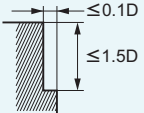
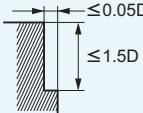
## VF-6MHV

End mill, Medium cut length, 6 flute, Irregular helix flutes

## VF-6MHVRB

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes

### Shoulder Milling

Work material	Carbon Steel, Alloy Steel (-45HRC) JIS S440, JIS S50C, JIS SCM		Austenitic Stainless Steel JIS SUS304, JIS SUS316 Titanium Alloy JIS Ti-6Al-4V		Heat Resistant Alloys Inconel	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>6</b>	10600	2900	8000	2000	2100	320
<b>8</b>	8000	2900	6000	2000	1600	300
<b>10</b>	6400	2700	4800	2000	1300	260
<b>12</b>	5300	2700	4000	2000	1100	230
<b>16</b>	4000	2200	3000	1600	800	180
<b>20</b>	3200	1900	2400	1400	640	150
Depth of cut						

D : Dia.

- 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective. When cutting heat-resistant alloys, the use of non water-soluble cutting fluid is recommended.
- 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
- 3) The irregular helix flute end mill has a larger effect on controlling the vibrations when compared to standard end mills. However, if the rigidity of the machine or the workpiece installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set the depth of cut smaller.
- 4) Climb cutting is recommended.

#### For Your Safety

●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

## MITSUBISHI MATERIALS CORPORATION

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